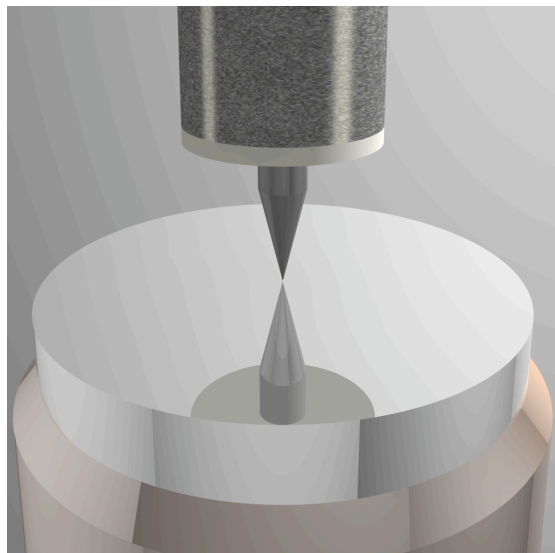
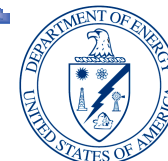
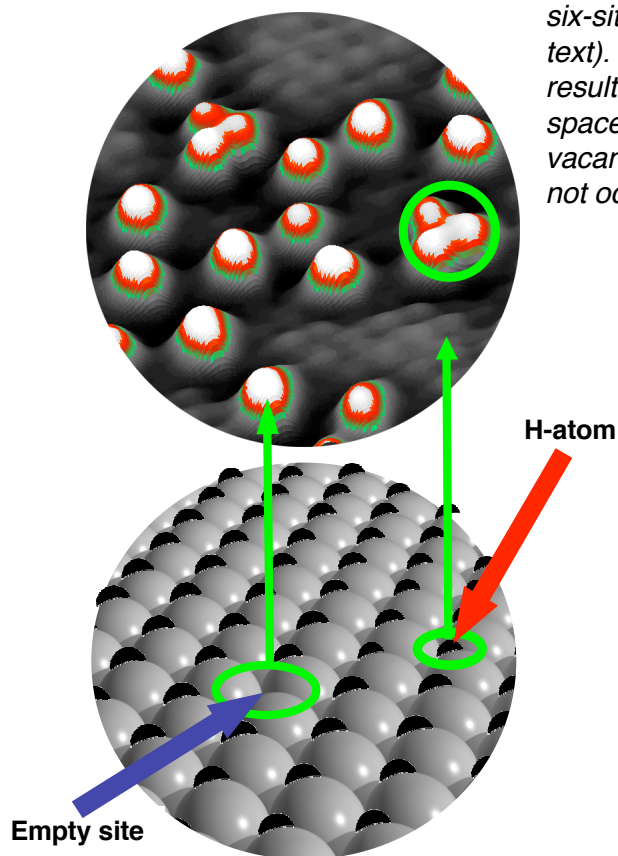


Catalyst Active Sites Imaged in Real Time

Three Empty Pd Sites Break Hydrogen Molecules, Two Don't



Scanning Tunneling Microscopy. A sharp tip is brought within a fraction of a nanometer of a surface and “rastered” (scanned) back and forth while the electrical current that flows (“tunnels”) between the tip and the surface is measured. The positions of atoms on the surface reveal themselves as changes in electrical current as the tip moves over them. The result is a high resolution image of the surface.



The STM “sees” sites on the metal surface occupied by black H atoms (red arrow) as dark, while single H vacancies (blue arrow) appear as bright spots. Clusters of two vacancies appear as three-lobed triangles (green circle). Clusters of more vacancies also have distinctive shapes.

A four-vacancy (A-D) cluster is seen as a six-site triangle, (middle) due to vacancy hopping (see text). Upon adsorption of an H_2 molecule, and the resulting “filling” of two vacancies, it becomes two spaced vacancies, here too far to appear as a three vacancy cluster (A-B, bottom image). Adsorption does not occur unless there are at least three vacancies.

